OCT 13, 1995 - 9AM

Bob Cooper's

OCTOBER 15 1995

SatFACTS

MONTHLY

Reporting on "The World" of satellite television in the Pacific Ocean Region

IN THIS ISSUE

POLARISATION
Coping with
four modes
on two-mode feeds

4 X 4.5 = 5 DAYS
From carton to tracking
of four 4.5m dishes
in 5 working
days

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Vol. 2 ◆ No. 14
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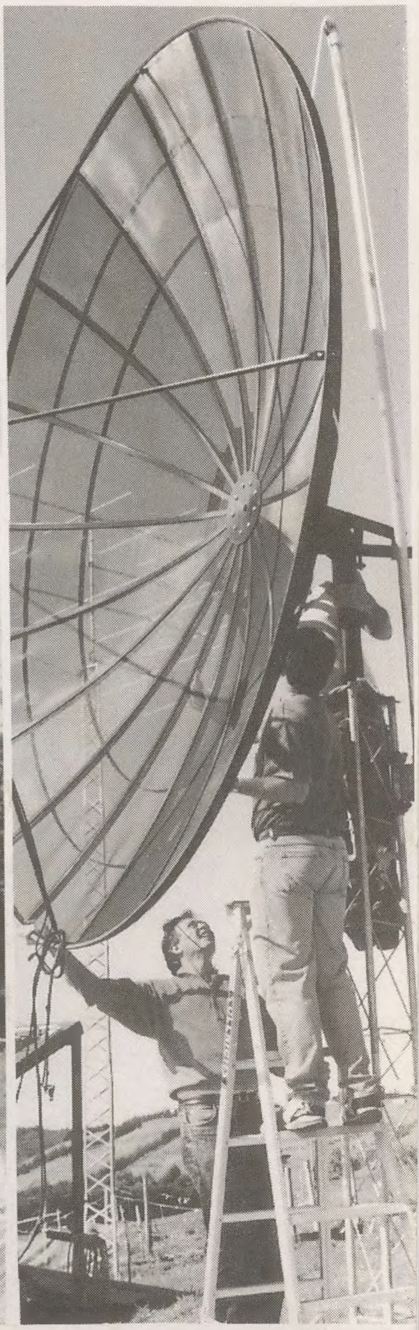

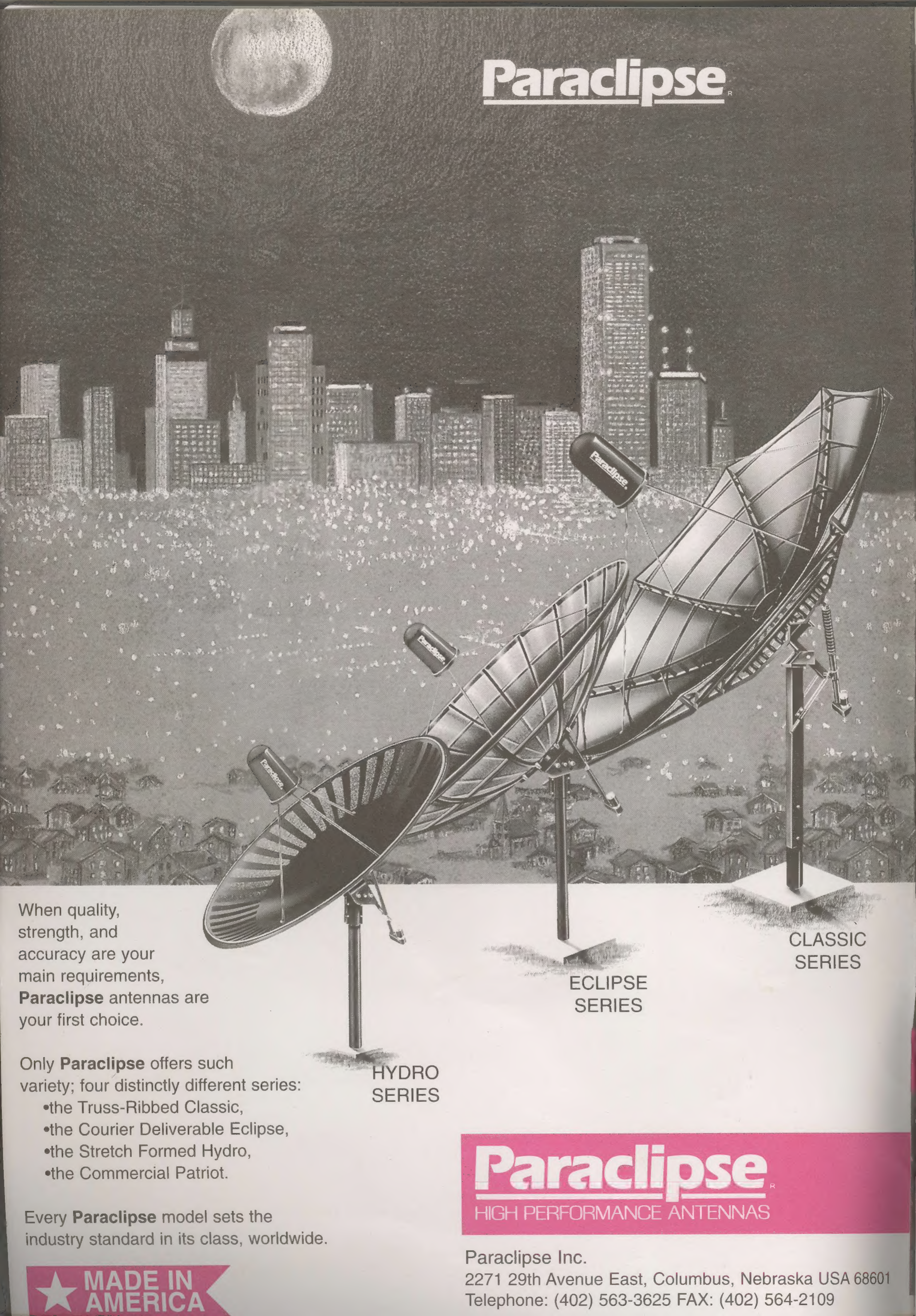
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SatFACTS
MONTHLY

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This publication is dedicated to the premise that as we enter the 21st century, ancient 20th century notions concerning borders and boundaries no longer define a person's horizon. In the air, all around you, are microwave signals carrying messages of entertainment, information and education. These messages are available to anyone willing to install the appropriate receiving equipment and, where applicable, pay a monthly or annual fee to receive the content of the messages in the privacy of their own home. Welcome to the 21st century - a world without borders, a world without boundaries.

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COOP'S COMMENT

October 15, 1995

The October 1945 issue of English monthly Wireless World published a paper by a 27 year old, 5 year veteran of the Royal Air Force, **Arthur Charles Clarke**. The title, *Extra-Terrestrial Relays,* was not Clarke's first title choice: He had called it, "The Future of World Communications," in submission to 'WW' and was paid 15 pounds for the piece. Decades later Clarke's plan to create geostationary orbit microwave frequency band relays in space would make others billions. Very recently, Clarke learned the now world famous essay was accepted for publication over strenuous objections by many on the 'WW' editorial board and one young editor staked his own position on having the paper published. Arthur would later recall, *"Otherwise, the article was received with monumental indifference."* You will note that October 1995 is precisely 50 years after this essay (first) appeared.

Gay Cooper, Arthur C. Clarke, Colombo: October 1994. The man still plays a mean game of table tennis.

Clarke feigns modesty when asked about the importance of this paper in pointing the way for world circling satellite television (radio, telephone et al). *"All of the elements were falling into place; the German V2 rocket, the development of microwave radar equipment - it all added up to what to me was obvious. One day mankind would communicate through satellite relays. If I hadn't written this in 1945, someone else would have done something very similar in a year or two."*

Perhaps. But people who might have done something seldom appear in history books. Primitive (Morse) code radio systems were struggling to communicate with ships at sea beyond distances of 100 miles when 27 year old Guglielmo Marconi in 1901 was first to claim reception of his Poldhu (UK) transmitter in Newfoundland, more than 2,000 miles distant. No one previously had crossed the Atlantic, nor covered such a distance, with "wireless." History books fail to record who was 'second' to accomplish this feat.

Arthur C. Clarke has received virtually every major prize and award this planet can bestow in recognition for his vision; only the Nobel Prize has eluded him to date and in 1994 he was nominated for this as well.

Every participant in satellite television owes something to Arthur Charles Clarke. I told him so during a five day visit my wife Gay and I made to his home in Sri Lanka this past November. Might I encourage you to send him a fax, or a hand written note, this month with your own, "Thanks for making all of this possible," gratitude? Arthur C. Clarke, 25 Barnes Place, Colombo 7, Sri Lanka; fax 94-1-698-730.

In Volume 2 ◆ Number 14

Departments

-ON THE COVER-

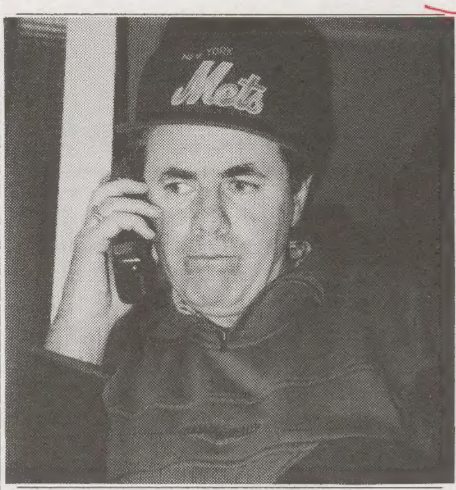
Low look angle 'fishing'. AsiaSat 2, Palapa C1 will be close to the horizon for many in the Pacific. Here, New Zealand's Doubtless Bay Cablevision installs a 3.7m Orbitron and 4.5m Paraclipse on elevated towers in preparation for satellite launches 'soon' (report p. 10). This month's cover colour chosen by Dave Holden, Holden Aerials, Auckland.

14 AR 16F

3+3
1

MEET
24 Modern
Kerry Lumsden

2+1



Lotus 9

He's not from New York and possibly is not certain which sport the "Mets" are engaged in. But take him a SMATV or cable TV system to design and he will hit a home run every time.

Kerry has all of the prerequisite credentials to be in business for himself: Ex Sky (4+ years as Field Service Supervisor and MATV/CATV system design and installation), Ex-Vidtronics (18 months as Training and Service Branch Manager) and Ex-Tisco (3 years as Service Manager). If it runs on electrons and is broken, he can fix it. Which qualifies him perfectly to evaluate and specify electronic and passive components for a cable or SMATV system, to design systems, to oversee their installation and then to make it 'play' when the installation is finished.

Share this man's unique Kiwi cable TV wisdom as a seminar leader Friday January 26 during SPRSCS.

AR 12

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ARIAL 16

PROGRAMMER PROGRAMMING PROMOTION

ARIAL 24

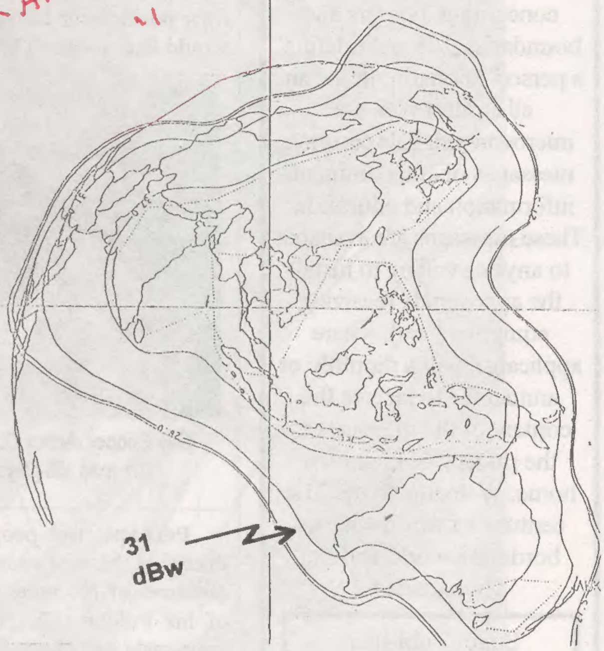
UPDATE

AR 12

OCTOBER 15, 1995

Those Palapa footprints. SF#13 displayed a trio of Palapa C1 footprints, one of which (p.7) was represented as the AustraZealand C band beam. It may not be. C2M, as we reported, has been known to have unique footprints (we did not include them in our C1 report) but now it appears C1 may also be equipped with 3 separate C band footprint options. One places 35+dBw coverage over New Zealand and eastern Australia (SF#13, p. 7); a second looks very much like existing B2P footprint (good only for C band dishes in Far Northern Australia) and the third is shown here. This is not nearly as nice with numbers like 30 / 31dBw over New Zealand, 34+ over much of Australia. Palapa won't say (citing "commercial sensitivities") which of the existing services on B2P will end up on each footprint. Paranoia over competition from other satellites could keep lid on this information until launch.

AR NARROW
+1



Deutsche Welle's Director of International Development, Dr. Burkhard Nowotny, plans Australian trip in November; perhaps someone should invite him out for dinner and explain the facts of DTH-life. Try fax 44-221-389-2784.

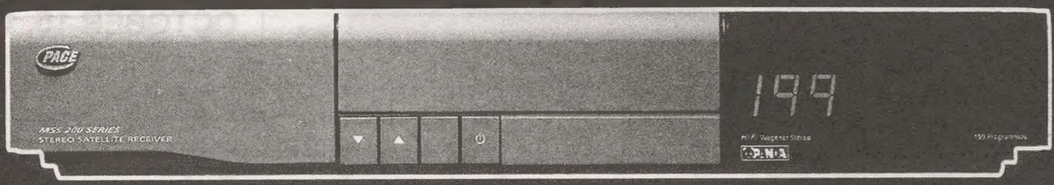
The good-ship Rimsat was kidnapped by Russian "pirates" September 10th and held hostage until the United States cavalry came to the rescue 4 days later but while the Russians were in control, Hindi service ATN was made to walk the plank. See report p. 24.

Until AsiaSat 2 can obtain launch (failure) insurance, this bird won't fly. Launch insurers that normally underwrite launches are not pleased with Chinese "wind shear" explanation for loss of ApStar 2 in January (see SF#12, p. 2) and are shying (or shearing) away from insuring AS2 launch. If the Chinese lose another one, they could be out of the international satellite launch game. Latest launch rumour: (Late) November blast off (see At Deadline, p.22).

Galaxy service on B3 using NTL / Iredito format MPEG has a burden not present with previous GI Digicipher service on B1: A 1.5 dB "penalty" because of greater bandwidth. Threshold for B3 digital reception requires extra (1.5 dB) signal, translating to larger dish sizes for equivalent reception. Couple this to lower footprint levels than planned for and you may have 1.2m dishes as 'standard' where 60cm had been original standard. Present signal is 'full power'.

Another Palapa B2P / C1 update. Queensland SF readers advise that "from time to time each week An-Teve, SCTV and RCTI switch on Videocrypt when telecasting movies and features." It typically lasts an hour or two; be advised.

EASY ACCESS,



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HARDWARE EQUIPMENT PARTS UPDATE

OCTOBER 15, 1995

Uniden, one of Japan's largest DTH receiver suppliers with more than 20 different models in line, will kick-off entry into South Pacific market with sizeable display at SPRSCS January 23-27. Firm pioneered mass production C-band receive systems in US market in 1983, is generally recognised as Japanese firm that pioneered America's first aggressively marketed home dish systems by doing heavy consumer promotion of joys of owning a dish system.

Australian Galaxy service, saying it would kick off marketing and installation of B3 delivered 10+ channel DTH service in September did so with contract installers starting 1.2m antenna, LNB and coax installs for customers in Brisbane, Perth and elsewhere. Only one snafu: Subscribers are being told, "*We will be back in ... ahhh ... later with your 'decoder'.*" Ooops.

What is the best low threshold receiver for Pacific region service, price no object? SPRSCS Technicians & Testing Room will conduct "Receiver Shoot-out" during trade show using variety of full and partial (typically half) transponder wide signals. Testing will run January 24-27 with TISCO's Barry Ward and enthusiast Robin Colquhoun doing comparisons on elimination basis: The one receiver left 'standing' at the end will be proclaimed best-of-show. This one could be a heart stopper.

ARC-SET dish alignment tool is three-bubble (as in a carpenter's level) device that makes dish set up for full arc tracking idiot proof. Designer Jim Roberts first introduced it in USA more than decade ago; nobody has been able to do it better or simpler since. One bubble allows you to set dish elevation, second bubble allows setting declination (looking due north from your location) for 'Zenith', third bubble is used for satellite that sits closest to your western (eastern) horizon. You can track the complete belt in less than 10 minutes. Each ARC-SET tool is factory adjusted for your location and a 50 mile/80km radius. Information from Gourmet Entertaining, 3915 Carnavon Way, Los Angeles, Ca. 90027 (tel: USA-213-666-2728. A review of this nifty tool in a future SF.

PALCOM SL8000 "Super Receiver" now being tested for November (SF15) review works like its lower priced SL7900 relative but with exceptional unique features. Both have 32 step threshold extension plus 8000 has 3 IF inputs and moving picture in a picture ability. That means you can dial up a show to watch in main picture, and scan through band (on same or another dish) in smaller inset picture. With orthomode coupler on "Dish 1" you can scan same or opposite polarity with inset picture, at remote control command switch images between main and inset, or, watch C and scan on "Dish 2" Ku (or another C band bird). Our only problem so far: Learning to 'drive' this fancy machine!

A single feed that features high performance reception from linear vertical or horizontal, right or left (hand) circular has eluded designers world-wide. Dielectric plates inserted into linear feeds add either RHC or LHC but compromise linear in process by as much as 3 dB. In Pacific with all four polarisation senses available on C-band, providing all mode reception from controls at receiver without sacrificing performance on some mode(s) is a real challenge. AV-COMM Pty. Ltd. is field testing DBDMFH (dual-band, dual-mode feedhorn) which appears to be significant contribution to existing technology. Feed uses 3" bearings pressed into waveguide and 6000 rpm servo motor through gear box to rotate circular waveguide mounted LNB on support structure behind scalar rings. Unit could be ready for shipment by December, will display at SPRSCS.

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A Twisted Tale

THE POLARISATION GAME

2 MINUS 3

Too Many Standards

Without standards, there is often chaos; equipment pieces that will not directly interface, software languages that refuse to intercommunicate, TV transmissions that refuse to resolve on the screen. Standards are often developed to preserve a national identity (the French 819 SECAM TV system is an example), more often they are created to preserve a corporate empire (the GI Digicipher 1 is an example). Still other standards are chosen because of failure to fully grasp the technological significance of the problem the standard seeks to resolve. Satellite polarisation standards falls into this category.

From the earliest Marconi experiments with microwave in the late 1800s technologists have understood that radio waves can be "polarised"; made to conform to a specific physical format. Initially there seemed to be a pair of choices: Horizontal polarisation and its opposite, vertical. By the late 1930s two additional polarisation formats had been engineered: Circular right and circular left. Unfortunately for satellite users in the Pacific, all four are now in use by satellite operators.

The polarisation "sense" is established by the transmitting antenna at the transmitter you are trying to receive. For example, if it has selected horizontal polarisation, your receive antenna must do likewise. Radio signals and light waves can be polarised. Sound waves cannot.

Arguments Pro and Con

For decades terrestrial broadcasters argued, and tested, and retested polarisation hoping to identify advantages between vertical and horizontal. Most advantages turned out to be disadvantages on closer inspection. For AM (broadcast) radio, vertical proved "best" because it allowed receivers in all directions from the transmitting antenna to receive essentially the same signal coverage. FM and TV broadcasters found they could simultaneously use both to advantage since a receiving antenna "turned sideways" for a vertically polarised signal intercepts only a small amount of signal from a transmitter on the same (TV or FM) channel that is horizontally polarised. In this way, the frequency spectrum could be used once (horizontal) and then reused a second time (vertical) with greatly reduced interference between transmitters.

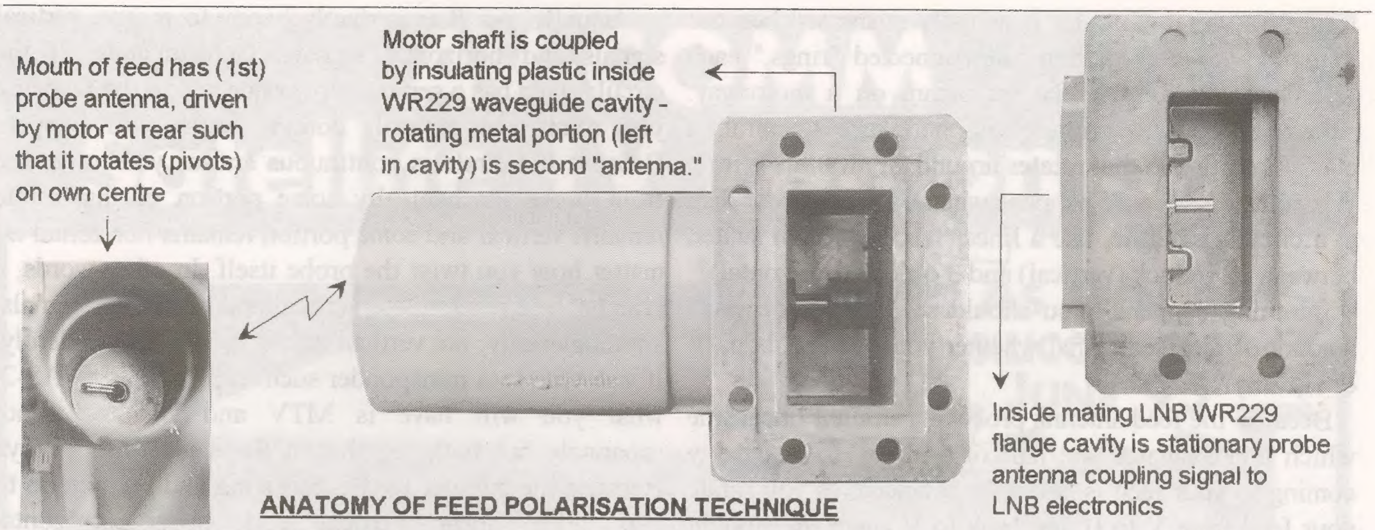
Early satellite system planners at Intelsat saw polarisation as a curse. If they could eliminate the need to hand tweak the feed antenna on the parabolic dish for best (same polarity) signal, that would be one more variable that might cause problems in the field. Circular polarisation was their answer. Unlike vertical or horizontal, each of which requires careful adjustment of the feed antenna probe to maximise signal, circular requires no adjustment. Simply mount the feed at the focus point and turn on the receiver; no further adjustment necessary.

Early satellite planners at RCA, when designing their first Satcom (F1) satellite, saw polarisation as a way of using the same C-band frequency band twice. They reasoned that if the satellite had 12 transponders connected to a vertically polarised transmit antenna, and 12 more (using the same transponder spectrum as the first 12) connected to a horizontal polarised antenna, on the ground it would be possible to install a parabolic dish with two separate feeds; one vertical and one horizontal. By doing this, they got twice as many transponders out of the one satellite; pretty neat.

The commercial installations (which in 1976 were the only installations using F1) didn't mind having to spend around US$6,000 for the "special" orthomode feed that gave them vertical and horizontal separately. The earliest backyard dish operators did mind since most of them had less than US$6,000 in their entire terminals. That's when a fellow (named Cooper) in Oklahoma adapted a $25 TV antenna rotator to physically turn the feed (rotating it) so his home dish could switch between vertical and horizontal. "Switch" is a slight exaggeration; it took 30 seconds for the TV antenna rotor to turn the feed from one to the other!

It was the summer of 1981 when a man named Gene Augustin first displayed a faster solution to the problem; a small servo motor that fit inside of a C band feed which on command from a small control box located at the home dish receiver switched the probe antenna inside of the feed from one polarity to the other in milliseconds. The Polarotor was borne and rapidly improved to the point that a user could scan from vertical to horizontal to vertical to horizontal channels almost at the speed of - well, if not light, at least the speed of a fast moving bullet train. Seemingly, mankind could pack away its R and D dollars for home satellite dish feeds; the problem had been solved.

Not quite. The Polarotor was an eloquent solution to a uniquely American problem. All US satellites used



ANATOMY OF FEED POLARISATION TECHNIQUE

(and still largely use) linear (vertical, horizontal or both) polarisation but elsewhere in the world Intelsat uses circular, Russian Gorizont uses circular, Rimsat uses circular, Japanese DBS is circular. And out here in the Pacific we have all four polarisation options in use, often on immediately adjacent satellites. This means that if you are going to equip a home dish system to receive all of the satellites in view, for the best possible reception from each, you need a feed that "does all four."

Finding such an animal can be a real challenge.

What You Can Get

If you look inside the (called WR-299) mounting flange on an LNB you will see a small shiny metallic object. Think of it as the "antenna" for the LNB. As you look into rectangular LNB opening, the "antenna" goes up and down across the "shorter distance": between the edges of the flange (lip). This "antenna" has a polarity and if you hold the LNB so that it is longer left to right before you, the "antenna" points up and down; or vertically.

This "antenna" is coupled to the real antenna, on the feed, through the waveguide. And waveguide is just like transmission line or coaxial cable; signals fed into one end come out the other with the same polarity as they began. The LNB "antenna" is fixed in position, it does not normally move. So to couple energy effectively from the "real antenna" on the feed to the LNB "antenna", the polarity between the two must be the same. At the LNB end of the feed antenna, a matching piece of waveguide with its own "antenna" inside is fitted parallel to the LNB "antenna". Energy captured by the feed is sent through the waveguide to the small "antenna" at the back end of the feed waveguide and then it radiates (within the waveguide but through the air) to the LNB "antenna."

This may seem a long way to go to travel such a short distance, but there is good reason. If the LNB "antenna" polarisation is fixed, and the rear-or-waveguide "antenna" is fixed in the same polarity, this now provides a method to change the receiving system polarity without physically altering either the LNB "antenna" nor the matching antenna at the rear of the feed waveguide. How is that?

If the LNB "antenna" and the rear of waveguide "antenna" do not move, but you can somehow change the "real feed antenna" sense of polarisation, then the signal that travels from the front of the feed through the two fixed "antennas" can be polarised to suit your needs. In other words, move only the front "antenna" (the one that you see when looking into the feed proper). If it is "vertical" then only vertical signals will flow through it to the fixed "antenna" at the rear of the waveguide; if it is horizontal, then only horizontal signals. The rear waveguide "antenna" and the LNB "antenna" don't care because to them their own sense of polarisation has gone unchanged.

The small servo motor within the feed rotates the front "antenna" (probe), typically through 180 - 190 degrees of rotation. It doesn't need more than that because if 12 o'clock is vertical, so too is 6 o'clock; and if 3 o'clock is horizontal, so too is 9 o'clock. In actual fact, you could get by in most circumstances with just 95 degrees of rotation (12 o'clock for vertical, 3 o'clock for horizontal). We'll see why you may on occasion require more than 95 degrees later on.

Well, that covers obtaining vertical or horizontal quite nicely. Now you can programme your satellite receiver such that each time you select a vertically polarised channel a (signal) voltage goes up the line to the servo motor to tell it to switch to 12 o'clock, and each time you select a horizontal channel, the probe moves to 3 o'clock. Or, you could rotate the probe yourself by remote control using a V/H switch on the receiver or remote control.

But what about circular?

Circular means that the energy transmitted by the satellite is spread out not in a straight line (12 o'clock for vertical, 3 o'clock for horizontal), but rather in the

form of a spiral. Circular is actually misnamed because it implies a series of non interconnected "rings," each following the former like motorcars on a motorway. Actually, the wave polarity is more like a spiral, a continuous thread that rotates around an invisible centre. What do you suppose happens when you point your dish at a circular satellite, use a linear feed, and then switch between 12 o'clock (vertical) and 3 o'clock (horizontal)?

Nothing happens. You should see exactly the same amount of received signal whether your feed probe is V or H. Why?

Because the feed antenna probe is a straight linear line which approximates one half of a circle. If the energy coming to your feed is perfectly balanced, as you rotate your feed from V to H and back to V again the straight line linear "antenna" continues to see just half of the energy present. It totally misses the other half of the signal which means that 50% of the satellite signal received by the dish is left behind in the feed. This should explain to you why a linear feed used on Rimsat or Intelsat will create a weaker picture than a circular feed on the same dish. For some circular signals (such as RAJ-TV and EMTV) leaving half of the signal at the feed may not be a disaster; there is so much signal you can give 50% away and still have satisfactory pictures. On other circular signals, such as those from Intelsat 174 / 177/ 180, leave half the signal behind and you may have so little left you can't watch the picture.

One solution is a feed designed specifically for circular polarisation. Now the front "antenna" responds to spiral shaped circular signals because it, electrically, is a spiral or circle itself (this may not be obvious to you when you look at the feed). If this front feed antenna is properly (circular) shaped, then the energy it receives is polarity converted at the rear waveguide "antenna" to be linear so as to match the "(probe) antenna" mounted inside of the LNB. Thus just as the LNB does not care whether the signal came into the feed vertical or horizontal, as long as the front feed antenna probe is properly configured and placed, so too does it not care if the signal is circular since by the time it reaches the LNB "antenna" it is now linear anyhow thanks to the waveguide "transition."

So what happens if we make the front or feed antenna circular and then wish to receive linear signals? Does it really care?

Actually, no. It is perfectly happy to receive vertical signals and horizontal signals. Unfortunately, if the circular feed has a servo motor connected to the feed and you rotate the control, nothing much will happen. Because the circle is continuous and as you rotate the front probe mechanically some portion of that circle remains vertical and some portion remains horizontal no matter how you twist the probe itself. In other words, a circular feed responds to vertical and horizontal signals, simultaneously; not vertical or horizontal independently. If you tune to a transponder such as 3 (or 4) on PAS-2, what you will have is MTV and Discovery; not separately but both together at the same time. Why? Because the circular feed is receiving and passing on to you both linear vertical and linear horizontal simultaneously. Try straightening that out with your receiver! And by the time we arrive at Palapa C1 (see SF#13, p. 6) this problem will become far worse since virtually every transponder number has separate vertical and horizontal signals on board.

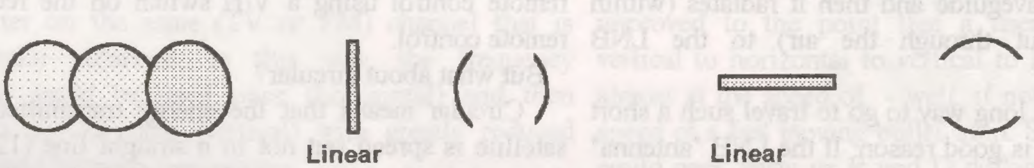
So circular doesn't work for linear signals, and, linear does not work for circular (very well). Could you design one front feed "probe" (antenna) that has selectable characteristics of either linear or circular?

<u>There are Two Circulars</u>

Before you can begin designing, there is one additional consideration: There is right hand circular, and left hand circular. Remember that circular should have been called spiral and a metallic wound spring is an approximation of what the signal looks like.

Right hand circular (looking at the signal from the satellite itself as it leaves the satellite) winds counter clockwise in an elliptical spiral. Left hand circular winds clockwise. Just as it is possible to use horizontal and vertical within the same transponder space (i.e., use the same frequency band twice; once for each polarisation), it is also practical to use RHC or LHC simultaneously since a feed on the ground adjusted for RHC will not even know the LHC signal is present (just as a horizontal feed will ignore the vertical signal on the same transponder frequency). Intelsat I180 does this (see Orbit Watch, p. 27).

So now our feed must be able to individually select linear vertical, linear horizontal, right hand circular or left hand circular. Rimsat signals, by the way, employ LHC. The design just became more complex. We'll see why in SF#15.



Circular polarised signal - **Linear Vertical probe captures only 50% of signal -** **Linear Horizontal also captures only 50% of signal - a 3 dB penalty.**

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The Numbers Game

4 x 4.5 = 5

FOUR BIG ANTENNAS IN FIVE DAYS

Tim's Fine Trip

Californian Tim Alderman had long craved a trip to the South Pacific. As a designer / builder of SMATV systems for a US firm his frequent trips to Russia (6 in rapid succession in recent times), he travels under the pseudonym of Captain Electron in the e-mail world. A number of New Zealanders would end up calling him 'Doctor Dish'.

The circumstances were right. Alderman's 12 year expertise with Paraclipse antennas is so refined that he is frequently called upon by US dealers to help sort out difficult installation problems. Bay Satellite's first container load of Paraclipse antennas had arrived in New Zealand, and, four of the 4.5m Islander antennas were scheduled for cable TV system installations almost immediately. Alderman would fly from Oakland (that's in California; please don't tell me the story of the poor chap who went to Oakland thinking he had found a bargain priced ticket to Auckland, again!) September 13 and return on the 20th; six working days to go from carton to functioning medium-large dishes. Then, to further capitalise on Alderman's visit, a major effort was mounted by Bay Satellite to videotape the assembly, installing and "arcing" processes to create a how-to-do-it video for South Pacific dealers to use in their own education programme. Alderman would turn out to be so comfortable before the camera that hours of tape would be piled up leaving Bay Satellite with a massive editing down job, or perhaps ultimately, two completely independent versions of "how to assemble and proof your Paraclipse."

Challenge One

Alderman's primary goal was education; his visit would fast-forward New Zealand TVRO installers past the often awkward world of trying to translate printed instructions from a manual to practical assembly experience. And while the resulting videotape would be the final medium for this teaching procedure, several New Zealand dealers and enthusiasts would participate in real time. They included Trevor Lenz of Top-Enz (Kaitaia), David Holden of Holden Aerials (Auckland), Steve Johnson of Franklin Aerials & Satellite Services (Pukekohe), Robin Colquhoun of Auckland and Stu McLeod of Hastings. Each of these people participated in the Alderman "Paraclipse School" in real time.

For Doubtless Bay Cable TV three 4.5 metre antennas were being added to an existing 5m, a pair of Orbitron 3.7m plus a 2.1m Ku dish. Standard 3.5" / 8.9cm schedule 80 steel mounts (see p. 18, this issue) would ultimately hold two of the 4.5m antennas, a 4m high Rohn 25G tower with angular steel bracing added would hold the third 4.5m. And one of the Orbitron 3.7m antennas would move from its existing schedule 80 pole mount to the top of a second 4m 25G tower to make room for one of the 4.5m antennas.

Why the tower mounts for two antennas? The 4.5m is scheduled for use with AsiaSat 2 which from the Doubtless Bay Cable headend site will sit at an elevation of 5.40 degrees. The site has a real horizon (i.e., as the antenna will look towards AsiaSat 2) of 0.1 degrees; a virtually "flat" table over water towards the new satellite. By lifting the 4.5m antenna off the ground so that its centre will be 4m above ground, the antenna will significantly reduce near field (close to the antenna) "earth noise." At this low a look angle, getting some ground clearance helps the antenna noise temperature go down. At the same time, the Orbitron 3.7m moved to the second 4m tower will boresight to Palapa C1 at 113E; a

Alderman (with hat) instructs on rib assembly; meshing and clipping

Baysat's John Lynam pushes clips, Alderman hooks from below. Antenna rests on empty cable spool to make it easier to get 'under' and behind for assembly.

look angle for Doubtless Bay Cable of 15.60 degrees. Again, the elevation of the antenna will reduce noise pickup from the near field ground below resulting in better carrier to noise ratios (C/NR) on the C1 signals.

Alderman's solution to placing dish antennas onto an elevated mount is a device called a "Dish Crane." In reality, this is nothing more complex than a "Gin Pole" slightly modified so that you can, with the assistance of a set of pulleys (block and tackle), translate the human pulling power of a couple of strong men into a lifting tool that allows you to place a 90 to 160 kilogram reflector assembly on a tall mast or tower without the use of a real world crane. As we will see, lifting a big reflector with a "Dish Crane" is only part of the challenge. A 4.5m reflector has as much surface area as many two and three man sailboats; the smallest amount of wind as you attempt to raise the reflector in the air and the satellite dish turns into a giant runaway Frisbee.

Basics First

Paraclipse antennas arriving in New Zealand by container are packed in heavy wall cardboard boxes. A 4.5m antenna, complete with mount and hardware, requires four people to lift and move. A forklift is a handy accessory just getting it onto and off of the freight line truck. The boxes are secured with heavy duty plastic fibre strapping by Bay Satellite before shipping and that's good because the oversized metal brads installed by the factory prior to shipping are really quite useless after the container has been shifted around a few times by the freight people. Ideally, antennas this large would be shipped on a pallet since the pallet base provides a stronger 'shelf' for shipping than the bottom of the cardboard box.

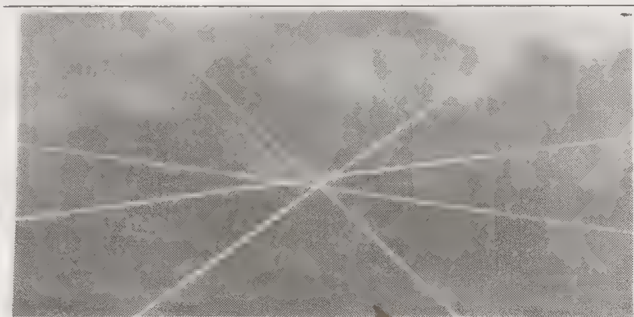
Doubtless Bay Cable had opted for the Stainless Steel hardware kit and a special set of re-enforcing supports created to strengthen the antenna's hub (central core) assembly in heavy winds. As you can anticipate from the photos, when a 4.5m is mounted 4m off ground on a tower, itself on a bluff overlooking the ocean 160 metres below, the wind stresses on this antenna during stormy conditions will be very significant.

Alderman's approach to assembly is akin to but not precisely the same as the well written manual. In particular, he is a stickler for "reflector proofing." A less careful installer would follow the manual and assume that manufacturing tolerances are such that if you build it exactly as outlined you will have a close tolerance high quality reflector at the end. Alderman makes no such assumption, and after assembling the central hub, ribs on the hub, and support rings he conducts a string test proof of the ribs.

1) There are 8 ribs on the reflector. After the ribs are mounted, the parabolic shaped rings are installed to interconnect the 8 individual ribs. Now take string and temporarily connect opposing members of the reflector ribs together such that each string connects across the front of the antenna. With four strings attached to 8 ribs, you now have a method of proving the reflector.

2) The four strings should cross at precisely the same point, and at the exact same distance from the hub centre. If the strings do this, the parabolic reflector surface will be accurate. If they cross randomly spaced around the centre point, it is necessary to shim the ribs and or adjust the inter-rib rings until the strings cross correctly at the one centre point.

3) Alderman uses a "straight edge" to determine how much correction may be required with shimming at the inner rib end to hub point. By checking opposing ribs with the straight edge (a piece of rigid PVC in photo) you can determine which strings are "high", or, "low," and then shim to correct. Those who view the assembly video will quickly grasp what is a bit difficult to describe in words, here.



Four strings, 8 ribs. Crossing at centre, two are out of line. Can you determine which two are wrong, and suggest a fix?

Truing the ribs, using the taunt rib strings as a reference, with (PVC) straight edge.

When you are finished with this procedure there is a bonus; you have "proofed" the support structure for the reflector surface, before actually putting the mesh in place, and as Alderman frequently observed, *"If you will settle for 20 thousands accuracy, it can be done in 15 to 30 minutes. If you want 5 thousands, prepare to spend the day at it. But it can be done."* If you are able to achieve 20 thousands error across the dish with your own construction skills, the dish will perform in actual use within 0.25 dB of its manufacturer's claim. On the other hand, if you simply take the parts out of the box and assemble without measuring you could be off by 100 to 150 thousands and lose a couple of dB in the process. An extra 30 minutes spent proofing and tweaking during assembly seems like a suitable trade off for optimised performance.

Meshing

Arguments about mesh *("Don't those holes let the signal through???"*) aside, installing the mesh is akin to putting up a fence in your backyard. By no stretch of the imagination can it be described as "fun." One man can do it alone (you pop the "blank" clips down from the top adjacent to a ring support, and then get under the dish and using a heavy pair of vice grips or pliers bend the protruding end back around the underside of the ring); two people (not necessarily men) can do it better with one "pusher" (on top) and one "bender" on the bottom. There are tricks to this Alderman taught (the mesh does have a "top side" and a "bottom side", a rubber mallet is important to correct any minor glitches on the edge cuts of the mesh usually created by shipping) and the raw video we saw at the end of each "shooting day" does an excellent job of teaching these. How long does it take to mesh a 4.5m reflector? How much beer do you have on hand??? (Empty beer cans, by the way, make excellent "shim stock" for correcting any errors you may find in the rib to rib positioning; that may mean you can buy a case or two of beer and claim the cost as a business expense because you are stockpiling "shim material!")

Reflector Mount

Alderman believes passionately in a dish alignment tool known as ARC-SET (see p. 4, here). The Paraclipse mount is exceptionally rugged; for the 4.5m they supply a square piece of schedule 80 stock approximately 51cm in length which slides down over the schedule 80 pipe mount base. For the smaller models, there is a round pipe that slides down over your schedule 80 mount pipe. The mount pieces go on first, then the reflector is lifted into position and secured through the back hub plate to the polar "T" assembly.

When the reflector and mount are "one," the feed support goes on. For the 4.5m the feed is held in place with four feed pole supports. Doubtless Bay Cable installed Chaparral "Dual Feed" orthomode (separate vertical and horizontal LNBs) feeds on two of the antennas, an AV-COMM F1700 and L1551 LNB combination on a third dish. The Orbitron 3.7m antenna was also equipped with a Chaparral orthomode feed and a pair of LNBs.

Although all four dishes will spend their lives permanently looking at a single satellite, 24" actuators were installed. Why? Alderman insists with any installation that the dishes will track the full arc (within the limits of the actuator working range) and as his video details, tracking is as simple as one - two - three if you

Mount goes on 8.9cm schedule 80 pipe welded into tower top; final mesh is added (middle) before dish is manhandled to tower top.

Many hands make light work, or mass confusion. Focal distance is checked on first 4.5m.

use a tool such as the ARC-SET. Paraclipse provides shims (not from spent beer cans!) to set the declination adjustment for your location and with the 4m tower mounted antenna he and Stuart McLeod managed to have it tracking from 0.1 degree elevation (flat on the horizon) to PAS-2 (49.01 elevation) in about 15 minutes time while hanging from tower belts. With a spectrum analyser we could see the Russian Gorizont 19 located at 96.5E with elevation of only 1.7 degrees, as well as the powerhouse Gorizont 25 (103.2E) with an elevation of 7.2 degrees. The dish now sits on silent sentry duty awaiting the launch and turn on of AsiaSat 2. And, as Alderman points out, should circumstances ever change the actuator will be ready to shift the dish to a new orbital assignment on short notice and because it tracks the belt properly "changing birds" will be a very straight forward future chore.

Captain Tim with a final tweak of orthomode feed

A word here concerning the choice of actuators for these large-sail antennas. New Zealanders had learned sometime ago to avoid "Made in Taiwan" actuators because their gear drives are notoriously weak. To that we must add that the Venture Actuator, USA made, is on the slightly too lightweight side for a dish as large as the 4.5m when it will be exposed to heavy winds. Shortly after the installations were completed, we measured 6 to 15mm of "creep" on actuators on the 4.5m dishes with wind gusts of up to 60 kilometres per hour. The dishes were fine, but the actuators "crept" or "slid" under the strain. You can correct for this by merely running the motor until you are back on the bird, but for cable TV system use this creeping is not a satisfactory situation.

Head To Head Comparison

With both Orbitron and Paraclipse dishes vying for installer / dealer selection, the opportunity to do side by side testing on PAS-2 signals with the Orbitron 3.7m and the Paraclipse 4.5m (Islander) was understandable. Under perhaps better controlled circumstances, others will undoubtedly do similar testing during the Auckland SPRSCS trade show in January. We note:

1) The larger Paraclipse surface produced on average 1.0 to 1.5 dB more gain than the Orbitron; it would have been preferable to have a pair of Orbitron and Paraclipse antennas of the same size, side by side;

2) As for ease of assembly, proofing, and general constructed quality, well ... you will have to form your own opinions at SPRSCS.

Number 4: Auckland

Meanwhile down in Auckland, Robin Colquhoun was dismantling a 7m screen mesh dish originally installed by the Barrycourt Motor Inn back in the late 1980s. In its place would go the fourth Paraclipse 4.5m for Tim. The 7m (New Zealand made) antenna was one of the first to be sold and installed in this country at a time when AFRTS from Intelsat was the only useful service. In the interim years, children (possibly guests at the Barrycourt) have repeatedly mistaken the dish for a giant trampoline and all of the lower panels had been beaten into the shape of a 39 week expectant mother (they drooped; a bunch!). With the Barrycourt system becoming the headend for the new Barryvision Neighbourhood Cable TV service, owner Norm Barry elected this opportunity to have the ex-trampoline dish replaced with a 4.5m. The Alderman roadshow moved to Auckland where, with the assistance of several dealers strong, clear pictures on all PAS-2 transponders were on Barrycourt in-room TV sets 8 hours after the lid came off the antenna carton. With a day to spare, Tim Alderman returned to California to catch up on his e-mail (tim@captain.electron.org) and plan his next adventure.

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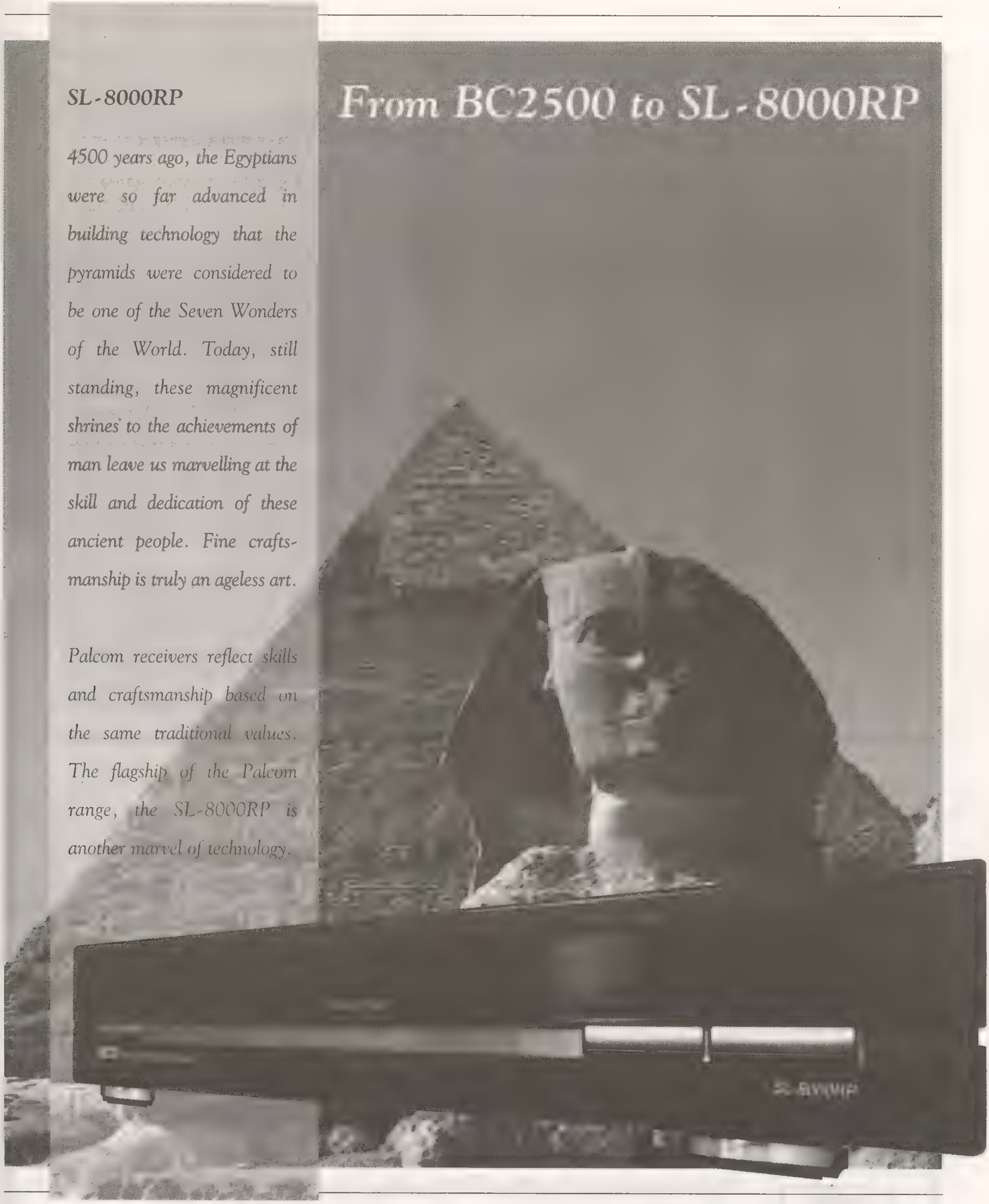

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Hear No Evil/See Nothing - Part Two:

UNDERSTANDING THE NARROWBAND SIGNALS ON SATELLITE

Audio As An Extra

With the forthcoming launch of AsiaSat 2 (SF#11, p. 6) and Palapa C1 (SF#13, p. 6), several new user / dealer opportunities arise with "narrowband" audio services. We tend to think of the audio (sound) portion of a television transmission as a necessary, often not terribly challenging addition to the basic video information.

The truth is that if you fully understand the audio services available with many of the newer satellite services, you will be better able to explain the advantages of satellite television service to friends and prospective customers. The sound quality of some services can actually increase the probability that you will be able to sell a home dish system.

Subcarrier Audio

Analogue satellite TV transmissions employ a frequency modulation (FM) format for video, unlike terrestrial television which amplitude modulates (AM) the TV video carrier frequency. By FMing the video carrier, extra narrowband signals (called subcarriers) can be added to the primary video FM signal. These narrowband subcarriers in turn are modulated with an audio (or data) signal

Thus the audio subcarrier essentially rises along, with the FMed video carrier, as a hitchhiker. It travels from uplink transmitter to satellite and satellite to receiving terminal as a part of the video carrier. Further, it remains a part of the video signal during all processing down to the video demodulator stage. Here the aural subcarrier spectrum is filtered and sent to a secondary receiver that is designed to only respond to the narrowband (audio or data) information present. The audio "tuner(s)" inside of the satellite TV receivers tune a special frequency range, and are typically designed for the transmission characteristics of the narrowband FM signal.

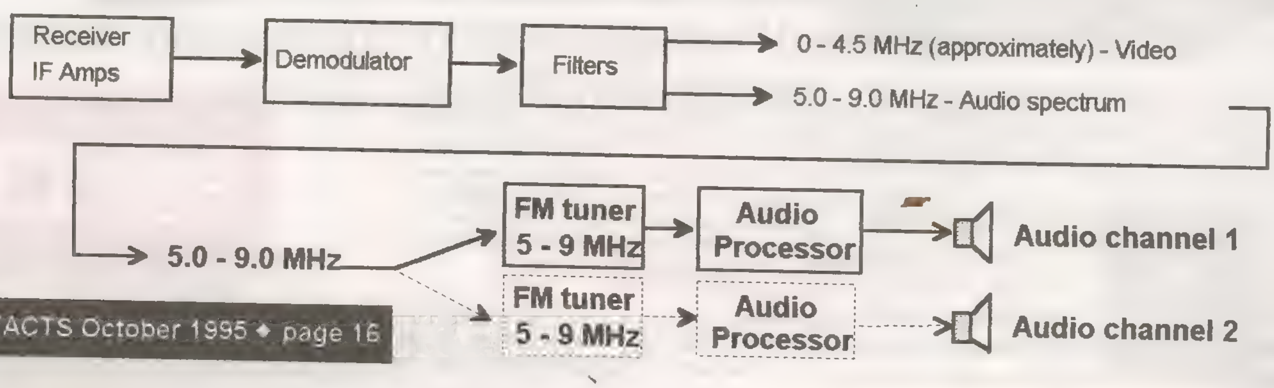
One audio subcarrier added to a television signal consumes on average 3-4% of the total transponder power. With the video signal there is frequency spectrum space such that several audio subcarriers, as companions to the video, can ride along. Your DTH or cable L band receiver, tuning 950 - 1450 MHz (+) includes a separate, second audio or narrowband "tuner" that tunes (typically) the 5.0 to 9.0 MHz region of the demodulated video carrier to capture these audio subcarriers. Note (see diagram) that the audio subcarriers are a part of the video signal itself, but "carried" in a portion of the video "spectrum" which is above (higher than) the bandwidth required for the picture information.

Thus subcarrier audio is a relatively inexpensive technique for adding "value" to an analogue TV service. In Europe and North American, transponders may have as many as 10 audio subcarriers and they are used for a variety of purposes. AsiaSat 2 and Palapa C1 will introduce the (south) Pacific to the varied audio services which to date have largely been missing from transponder services.

1) Programme Audio: Sound normally accompanies any television broadcast and the 'primary' subcarrier (usually 6.8 MHz or some number close to 6.6) is nominated for this purpose.

2) If the TV broadcaster wishes to transmit in stereo, he uses at least 2 subcarriers; one for the "left channel" signal and one for the "right."

a) However, since not all DTH / cable service receivers are equipped to receive stereo, the normal practice is to mix (matrix) the left and right hand sound channels to a third subcarrier so that all of the sound that accompanies a transmission can be tuned in on a single subcarrier frequency. This is called the "monaural" channel. An example of this on the Star TV service is the present B2P (113E; to be C1 in February)



on transponder 12V (970 MHz IF). The audio-left channel transmits on 6.30 MHz, the audio right on 6.48 MHz while the monaural (mixed) signal is on 6.80 MHz.

3) Additional audio subcarriers may be used alone (monaural) or in pairs (stereo) for a variety of purposes: STAR TV Hindi transmissions on AS1 (and to be available in the Pacific on AS2) use 6.3/6.48/6.8 in the previously described manner for the programme audio, plus 7.20 and 7.38 for "alternate language" monaural services. This allows a Hindi programme to be shown simultaneously in three separate languages. Or, the extra subcarriers can be utilised for totally unrelated audio. STAR TV's V Music channel carries BBC World Service Radio full-time on a subcarrier of 5.94 MHz, and BBC Mandarin language programming on 5.94 MHz with their Chinese service channel.

Stereo Receivers

The lowest cost DTH receivers have a single audio FM tuner built-in (see diagram, page 16). Middle and upper price bracket receivers typically offer two identical audio subcarrier tuners. The user will always find matrixed (monaural) programme audio in a free to air transmission even with a low cost receiver; stereo reception of course requires auxiliary equipment (such as a stereo sound system and speakers) to fully appreciate. Separate stereo FM subcarrier tuners are also available in the marketplace. With Hindi, Mandarin and some other STAR TV broadcasts, by employing earphones two people can enjoy the same broadcast each in their own language while watching the same screen.

And there is more to the subject, as we will review in SF#15.

STAR TV
EXAMPLES OF SUBCARRIER USE

STAR TV SERVICE	Subcarrier Frequency	Description
Star Sports	6.30 / Panda 6.48 / Panda 6.80	English left English right English mono
Channel V	6.30 / Panda 6.48 / Panda 6.80 7.20 / Panda 7.38 / Panda 7.56 / Panda	Programme left Programme right Pgm monaural BBC World-Eng. Star Radio left Star Radio right
Star News	6.30 / Panda 6.48 / Panda 6.80 7.20 / Panda	Programme left Programme right Pgm monaural Pgm monaural

Panda is a compression technique, to be explained in SF#15.

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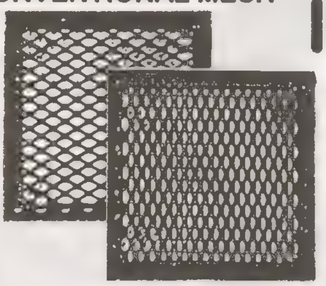
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The Heart Of A System:

DISH MOUNTING BASICS

Stick This Piece of Pipe ...

A satellite antenna represents a significant "static" object in the face of wind. Whether a dish surface is mesh or solid only changes the "level of stresses" placed upon the dish proper by the wind. Increased wind of course means larger pressures on the dish mount and subsequently by way of force transmission to the pipe that holds the dish.

Schedule 80 pipe, typically with a wall thickness of 1/4" / 6.5mm in the 3.5" / 88.9mm diameter required by many satellite antennas **(*)** has a bending momentum (point where it begins to bend away from its manufactured form), and, a breaking point. A 10' / 3.05m length of this pipe, typically used by installers, weighs nearly 40 kilograms. Any 3.05m length of pipe you can pick up without an effort is probably too lightweight to be seriously considered to hold upright a satellite antenna, solid or mesh.

Schedule 80 steel pipe has crossways rod welded to it at approximately 1/2 the hole depth

The depth to which you sink the mount pipe is variable; a function of:

a) The size of the dish being installed

b) The type of winds you expect (worst case)

c) The type of soil you have present

In "medium" soil, a 3.05m mesh dish should have a hole that is 19" / 48cm in diameter, 3'6" / 106cm deep for winds to 85 mph / 137 km/h. If the soil is "soft" (sandy), the hole depth goes to 4'6" / 137cm whereas in solid rock the hole can be reduced to 2'0" / 61cm. If the antenna will experience winds to 95 mph / 154 km/h, "medium" soil depth goes to 5'6" / 168cm.

Concrete mixed for a satellite dish pole is seldom high strength (mixing it on site contributes to this) and you are well advised to weld a piece of junk steel or rebar

Schedule 80 pipe is placed in hole and concreted in place; pole should be vertical with respect to ground, checked two times; once on each "side."

Mount proper takes different forms with different dish designs. Like this **Az**(imuth) **/ EL**(elevation) simplistic mount, it should fit snugly onto schedule 80 pipe (here 3.5" / 88.9mm in diameter).

crossways to the pipe as shown above. This prevents the pipe from rotating inside if the concrete encasement under stress.

YES - if you want the dish to track the satellite belt without applying special tricks (they do exist for crooked pipes), your pipe should be straight up and down; checked with a bubble level on two sides (a quarter turn apart) as the concrete sets.

Wind Loading

Unless you are trained in physics, the amount of wind "captured" by a parabola is mind boggling. An upgrade from an 8' / 2.43m to a 10' / 3.05m dish seems harmless enough; you hope you will realise approximately 2 dB more signal gain. What you may not realise is that the square area of a 3.05m antenna is 58% greater (29.21 square metres) than a 2.43m (18.54 square metres). Further, the volume inside of the parabola is 98% greater with a 3.05m (89.09 cubic metres) than a 2.43m (45.06 cubic metres). It is the "volume" of the wind pressing on the dish surface that creates the loading.

Isn't a mesh dish impervious to wind? Actually, no. The most scientific tests conducted on this question in the home TVRO field were done in the USA in 1984. Paraclipse took several models with different mesh patterns into a wind tunnel and measured the loading on the dishes as a function of wind speeds. Then to enhance the tests, they added wind driven water (this simulating rainfall driven by wind). Pages of reports resulted. The bottom line: A "dry wind" passes through the mesh surface with only modest amounts of wind being "caught" by the reflector mesh surface to around 30 mph / 49 km/h. Above that speed the mesh holes appeared to "fill in" as wind vortices formed eddies (puddles) at the mesh surface. By 80 mph / 143 km/h the surface effectively fills in to be a solid. Now, add water (rain) to the equation and the point at which the dish no longer appears transparent to the wind can be as low as 20 mph / 32 km/h) and where it fills in can be as low as 50 mph / 81 km/h with rainfalls of 100mm per hour.

The good news is that these tests and the calculations for wind loading always assume the worst possible case: The wind is blowing directly into the front of the dish at the same angle as the satellite signal (i.e., the wind is coming from the dish boresight). In the real world the dish points upwards and only on unfortunate occasions does it point directly into the wind. Therefore when you look at properly calculated "wind survival" speeds for antennas, the direction of the wind (and the amount of rainfall also present) must be taken into consideration. Dish installers should routinely advise customers to "stow" their dish at the highest look angle during heavy winds to reduce wind loading.

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* / Check your antenna manual for specific pipe size and hole sizes. Numbers appearing here courtesy of Paraclipse.

a technical and marketing advisory

memo

to the membership from your industry trade association group

SPACE Pacific

Satellite
Programme
Access
Committ**E**e

A trade association for users, designers, installers, sellers of private satellite-direct systems in the Pacific Ocean Region

Programmer Source Update

In SF#10, p. 18, we reported on 26 separate programme sources, their contacts and fax numbers. With the forthcoming launch of AsiaSat 2 and Palapa C1 our programme universe will expand exponentially and a thorough revisit of all sources available after these two launches will appear (probably in the March 1996 edition). The sources shown here are for PanAmSat PAS-2; not all have indicated a willingness to be utilised for DTH or CATV services at this time. Asking them "how you can be authorised" would be a positive step towards possible future availability, however.

Specifics

ANBC/CBNC: Now saying it will remain free to air (FTA) until March 1996. They had previously announced plans to use a Philips format MPEG-2 (back in March) but have not spoken about their plans recently. Second programme service, "NBC Super Channel," is another topic they are not presently talking about. For now, FTA.

CTN/Chinese Television Network: Currently available through some Australian agents (SF#13, p. 20) including a hotel price of US$32.85 per room per year; not available through any NZ agents. More details in SF#15.

CNNI: Has switched from B-MAC encryption on Palapa B2P to FTA, audio 6.8 MHz. This may indicate a change in corporate policy relating to encryption plans for this service.

ESPN: Currently available to hotels in Pacific for US$30 per room per year but probably not available in areas served by affiliates such as Sky; details in SF#15.

Family Channel: USA based quasi-religious programmer with "old fashioned virtues" programming appears to have cancelled plans to distribute on PAS-2, will distribute programming initially on tape to broadcast and cable affiliates in Pacific.

Galaxy: Now operating on so-called High Performance "banana beam" and finding ground signal levels in some key Australian areas below expectations. Investigating possible switch to a "National Beam" on B3 in lieu of high performance beam which, as an aside, could have positive applications for New Zealand as well since National Beam spillover is sufficient (tests suggest) for 2m range dishes in New Zealand to produce usable MPEG-2 reception. Quite separate from the technical possibilities of a National Beam switch, unanswered at this time are programming rights questions and copyright clearance for New Zealand customers. Don't look for an early resolution.

The Filipino Channel: Advises they will not consider switching from GI Digicipher 1 to "2" until late 1996 at earliest; continues to be unavailable to DTH.

MTV Mandarin: Presently on PAS-2, is only available to SMATV (hotel) or cable *"if a case can be made that the hotel caters to or the cable system serves significant Chinese (visitors)."* Meeting that test, rate is US$25 per hotel room per year; details in SF#15.

TCS / Television Corporation Singapore: Service launched 1 October (PAS-2, same transponder as ABN, SA MPEG) but only to cable and DTH subscribers in China, Taiwan. They say they will begin to consider (south) Pacific subscriptions after 1 January.

January SPRSCS Lodging Update

South Pacific Region Satellite & Cable Show host hotel, the Barrycourt Motor Inn, is projected to be filled

WHAT? YOU DON'T BELONG TO SPACE - YET???

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CURRENT PAS-2 CONTACTS

ABS-CBN: The Filipino Channel. GI Digicipher 1, NTSC. Contact Rhea Farreo tel 63-2-924-4101, fax 63-2-924-2732.

ABN: Asia Business News. Scientific Atlanta MCPC MPEG 1.5, NTSC. Contact Paul Shaw tel 65-323-0488, fax 65-323- 0788.

CBS: Columbia Broadcasting System. Scientific Atlanta MCPC MPEG 1.5, currently NTSC (plans switch to PAL). Contact Nell Donovan tel 1-212-975-3290, fax 1-212-975-6452.

CTN: Chinese Television Network. Scientific Atlanta MCPC MPEG 1.5, NTSC. Contact Bernard Cheung tel 852-2515-6333, fax 852-2505-7430.

CCTV: Central China Television. Scientific Atlanta MCPC MPEG 1.5, NTSC. Contact Liu Yiqing tel 86-10 851-1154, fax 86-10851-5505.

CMT: Country Music Television. Scientific Atlanta MCPC MPEG-1.5, NTSC. Contact Carolyn Gossman tel 1-203-965-6424, fax 1-203-965-6398 (Note: Represented in NZ, Pacific by SPACE Pacific Ltd.; fax 64-0-406-1083).

Discovery Asia. Scientific Atlanta BMAC, PAL. Contact Mark Lay tel 852-2887-1199, fax 852-2810-8456.

ESPN: Entertainment (&) Sports Program Network. Scientific Atlanta BMAC, NTSC. Contact Alexander 'Sandy' Brown tel 852-2887-1199, fax 852-2887-0813.

(C)NBC: Cable National Broadcasting Company. Analogue PAL, FTA. Contact Sergio Getzel, tel 1-212-333-7546, FAX 1-212-475-4988.

NHK: Nippon Hoso Kyokai. Analogue NTSC, FTA. Contact Noriyoshi Fuji, tel 81-3-5478-3330, fax 81-3-3466-7789.

Orient Satellite Communications. (Ku, China Beam) Scientific Atlanta MCPC MPEG-1.5, NTSC. Contact Robert Lee tel 886-2999-6638, fax 886-2999-5039.

Prime/Liberty. Scientific Atlanta MCPC MPEG-1.5, NTSC. Not full-time. Contact Jill Miller, tel 1-303-333-1300, fax 1-303-333-4644.

TCS: Television Corporation (of) Singapore. Scientific Atlanta MCPC MPEG-1.5. Contact Chang Long Kiat, tel 65-350-7188, fax 65-253-3780.

TVBI: Television Broadcasting International. (Ku, China beam). Scientific Atlanta MCPC, MPEG-1.5, NTSC. Contact Stanley Tang, tel 852-335-3391, fax 852-358-3227.

TLN: The Learning Network. Compression Labs Inc. MPEG-1. Contact Ken Widdowson tel 61-3-699-7147, fax 61-3-699-4947.

Turner International, Inc. (CNN + TNT/Cartoons). CNNI analogue NTSC, FTA. TNT/Cartoons Scientific Atlanta BMAC, NTSC. Contact Brian McGuirk tel 852-2802-7228, fax 852-2804-6415.

Viacom International Inc. (MTV Mandarin). Scientific Atlanta BMAC, NTSC. Contact Linda King tel 1-212-258-8586, fax 1-212-258-8513.

with show registrants by approximately the 1st of November at the present rate of growth. Those staying a minimum of 4 nights and requesting the Barrycourt are being lodged there. When it is full, the Barrycourt will direct you to alternate nearby lodging quarters.

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WITH THE OBSERVERS

AT DEADLINE:
Deutsche Welle advises SF that AsiaSat 2 was to arrive from (the) USA on October 12 in China and it will be fitted to the Long March rocket for a planned lift-off between 25 November and 9 December. Based upon that schedule, DW will begin testing its MCPC service at the end of January (we hope by 23rd!). They will use QPSK modulation, an 8 Mbps PAL format with a 128 kbps audio channel . Details SF#15.

JCSAT-3 is on station and transmitting. The latest Japanese C + Ku bands satellite was launched August 29 and immediately observers began to pay attention to 128E; just a "notch" west of Rimsat G1 (RAJ-TV). As noted here last month, several believed they were seeing JCSAT-3 "test signals" (carriers) in the 1500-1600 MHz (IF range) region but these are not JCSAT-3; rather they belong to Russian Raduga 27 at 127.6E. There is an especially strong "data carrier" at receiver IF of 1530 MHz. The first confimed "sighting" was mid-day on October 7; Av-COMM's Garry Cratt found a horizontally polarised signal at 4022 MHz (IF 1128), a test card with "JCSAT-3" in view. On a 3m dish, it was P2 on a Palcom SL7900 with TED in the low 20s. Acting on Garry's tip, SF took a 4.5m with LHC feed from RAJ-TV to JCSAT and found live video tests on IF of 1107.5 and an unmodulated carrier at 1192.5. Both were P5 in level; same as TNT on PAS-2. Earlier, one possible carrier was noticed at 0945 UTC on September 19 by David Pemberton (Muswellbrook, NSW) on an IF of 1170 MHz; a blank screen (no modulation) but David notes, *"Had it been modulated, it would have been P5 based upon the signal level meter reading on my receiver."* So JCSAT-3 is alive and well and 128E will require watching.

PAS-4 operations are slowly expanding and Harald Steiner in Tokyo reports reception of ESPN (free to air) is P2 in PAL at 3865 MHz (IF 1285) on a 1.2m dish. From Western Australia Peter Merrett reports finding the "Sony Entertainment, Singapore" test card at 3905 MHz vertical (IF 1245) P4 on a 16 foot antenna (Sony Entertainment: fax Rohinton Kapadia 91-22-2852985). He has also seen tests far stronger on 3912 MHz horizontal (IF 1238). PAS-4 at 68.5E has three distinct C-band coverage beams (see SF#13, p. 23) and Australia shares one of these with SE Asia.

Optus B3 Galaxy signals are now at full power and using High Performance Beam which was designed to maximise coverage over populous coastal areas of SE Australia, plus Perth region. Tests indicate the beam's optimised area is approximately 1 dB higher in performance than would be realised with a "National Beam," according to a Galaxy source. In fact, in Western Australia Peter Merrett measures 23 dB carrier to noise on the high performance beam signals while the B1 high performance beam signals (in use by Galaxy) measure 21 and 19 dB (C/NR). For comparison, the National Beams nominally measure 17 dB C/NR at the same location. Galaxy B1 service using General Instrument Digicipher 1 has a shut down date of 15 November. A number of SatFACTS readers in Australia report they have begun making contract Galaxy DTH installations but the installs are only partial: PACE receivers are not being put into the field at this time. Antennas (1.2m in Brisbane), LNBs, and cable are being installed with PACE IRD units to follow at some uncertain future date. A sizeable quantity of the receivers (30,000) is due into Australia in November alone. To date, the receivers have not been put into the field because of a "software glitch." Galaxy remains optimistic the "glitch" will be resolved shortly. B1's Galaxy programme channels have had CTN (Chinese Television Network), TeleItalia, ANBC and (music channel) Red in fta MPEG since late September but they are scheduled to disappear in mid-November when the GI equipment is shut down and Galaxy abandons B1 transponders 10 and 11 (H).

Getting above the vegetation was a challenge for Shane Wilson's(Qld.) Ku (left) and C antennas.

WITH THE OBSERVERS: Reports of recent changes in satellite operations, programmer sources, equipment changes are encouraged from readers throughout the Pacific Ocean Region (POR). Information shared here is a valuable tool in increasing our collective understanding of the POR satellite system 'universe'. Off-screen photos are not difficult to take: Use ASA 100 speed film, set camera to f3.5 -f5 aperture and for PAL or SECAM image set to 1/15th of a second (for NTSC, 1/30th). Adjust TV screen to slightly brighter than normal with normal contrast, hold camera stable or place on tripod. Alternately, record reception on VHS tape (any format, any speed) and send the tape along to SatFACTS for photographing. Note deadline for November issue is 5PM (NZT) November 3rd; you may also FAX reports using form on page 29 this issue to 64-9-406-1083.

Teleltalia is temporarily FTA in GI Digicipher 1 via Optus B1, TR10 along with CTN, Red, ANBC

Observer Shane Wilson, fortunately located at Mareeba in Queensland, finds BMAC services on ApStar 1 at receiver IFs of 1012, 1094 and 1288 while CNNI is on 1170 and Reuters is on 1372.

Steiner in Tokyo reports Ku activity on Intelsat 503 at 177W has suddenly dropped in signal level into Japan such that smaller dishes no longer can see USA feeds formerly available there. Also in past month, CNN has moved from 503/177W to 511/180E and to 11,510 MHz horizontal (USA ABC was formerly here). USA CBS network continues on I180E on 11,480.

David Pemberton finds video feeds on Intelsat 503 at 177W with feeds from I.B.V., Papeete, Tahiti, on receiver IF of 983 MHz, right hand circular (RHCP). He is not convinced this satellite is as badly "inclined" as has been reported

Some format changes: A number of observers relate that CNNI on Palapa B2P (IF 1170, vertical) has abandoned BMAC and returned to analogue PAL with an audio subcarrier on 6.8 MHz. For a brief time late in September CNNI feeds on PAS-2, which flow through to B2P, were advising viewers to retune their B2P receivers for CNNI audio at 6.8. On Intelsat I180, the long available NBC/Net 7 feeds on IF of 1277 adopted the Leitch encryption system on September 27. In August the NBC and mixed feeds on IF of 1385 changed to MPEG; there will shortly be almost nothing of value for fortuitous reception left on I180.

The Mandarin language NTSC analogue service previously reported on receiver IF of 1034 MHz by many observers from the PAS-2 Ku side has been confirmed as now being MPEG format. The signal was widely seen from Perth to New Zealand during the June to early August period.

CNNI on PAS-2 experienced significant technical problems between 0600 and 0930UTC on October 5th; complete loss of programme material through California uplink for extended periods of time, although carrier signal remained.

French bomb tests. One way to keep up to date is WTN (I174E/177E); another is IBV on I177W.

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RUSSIANS TAKE CONTROL OF RIMSAT G1 + G2: BRIEFLY

AT 0000 UTC on September 10 Russian satellite controllers acting on instructions from the Russian Space Agency and government backed Informcosmos took over complete operational control of RIMSAT G1 (130E) and G2 (142.4E). In command, their next action was to shut down transponder R6 on G2 effectively taking Asia Television Network (ATN) off the air. And then all hell broke loose and a New Delhi (India) newspaper front page report inflamed Indians against the "Russian Piracy."

Rimsat - Russian authority problems began several years ago. They do not agree on the details of their disagreements, each side claims different "facts" to support their own position. The Russians claim they are owed money by Rimsat; Rimsat says they are owed progress by the Russians. And the unravelling of the intrigue is greatly complicated because of pending lawsuits in the US against various Rimsat principals. The Russians in taking over Rimsat acted neither hastily nor without probable cause. Of course Rimsat disagrees.

ATN: Singled out as example by Russians

On August 21st Intersputnik sent faxes to all Rimsat users advising them to make current their accounts owed to Rimsat not later than August 31, or they (the Russians) would kick the in arrears satellite programmers off of Rimsat. This was more than a threat; even though Rimsat leases the two Soviet Gorizont satellites from Informcosmos, the Russian privatised space company, the Russians continue to "fly" both G1 and G2 and the Russians have all of the important command buttons. The Russians could turn off any transponder they wished and Rimsat (from its uplink at Subic Bay, Philippines) could do nothing to stop them. The programmer customers on Rimsat were understandably alarmed, and confused. To be sure, some (including ATN) were "in arrears." The Russians cited the failure of Rimsat customers to remain "current" with their lease payments as proof that Rimsat could no longer operate effectively. On August 24th, Rimsat's director of marketing Tim Brewer (familiar to SF readers) was hastily summoned from Bangkok to Moscow. Brewer has not been heard from since.

To further confuse Rimsat's clients, Intersputnik also advised them in the August 21st faxes that effectively immediately payments were to go to Moscow, and, the price for Rimsat transponders would be "the market price." Translation? Most would, if they were to continue with Intersputnik in charge, pay 100% more (or twice as much) for their transponders as they had been obliged to pay to Rimsat direct. Seemingly, the Russians were not concerned that they might lose some of the existing Rimsat clients by doubling the rates; certainly there are many other would-be-programmers in India and Asia who would happily pay the higher rate to gain access to the wide area coverage of Rimsat.

On August 30th a United States Federal Court heard an emergency plea from Rimsat, and responded by granting an "Emergency Restraining Order," effectively blocking the Russian take-over of Rimsat. The Russians had previously agreed to submit their disputes (there are many) with Rimsat to binding arbitration by an international body. But the faxes of 21 August stepped over the Russian agreement to arbitration and went ahead with the earlier threats of a take-over. The Russians then backed off ... until September 10th. Just as Rimsat and its US backers thought the take-over had been averted, the Russians flexed their muscles by zapping ATN from TR6 of G2 thereby sending a message to other G1, G2 programmers. Indeed, they got the messsage; the Russians were in charge.

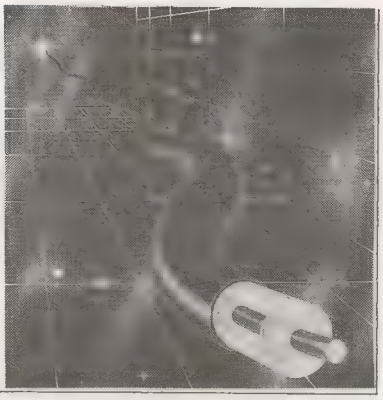
The Russians are bound to the arbitration process only by their promises; and, in fact, they could (and ultimately would) ignore the August 30th US Federal Court Emergency Restraining Order.

ATN remained off of G2 until 0000 UTC on the 13th of September; 72 hours. Then, with a couple of false starts, they reappeared. In that 72 hours numerous influential US political figures protested the Intersputnik take-over. Several of those protesting serve on the Senate Committee of Foreign Affairs and the (US) House International Affairs Committee. They were in a position to exert significant pressure on the Russian government which in turn could (and ultimately did) order Intersputnik to back off.

Since September 13th, G1 and G2 services have been operating in what is "normal" for each. Observers tell CTD, "*Some of the signals are better than previously*" and some G1 signals (such as JJAY TV on IF of 1425) are now being seen in portions of Australia where they have not been previously seen. All of this points up that whoever is in charge of the uplinking for G1 and G2 today, they are operating some (perhaps all) of the transponders closer to saturation (full power) than was previously the case.

The future of Rimsat is very cloudy. It has huge internal stockholder strife (including one US$300 million lawsuit), no real staff above the technical level, and somehow must negotiate itself (without an effective management staff) out of the mess it is in with the Russians. Changes are to be expected in observed operating conditions for the indefinite future; your reports are solicited.

THE CABLE CONNECTION



Costs. What should it cost to install a cable TV plant outside of its headend property? With dozens of motel and hotel based SMATV systems being installed throughout the Pacific, and many planning to "share" their services with other nearby homes and commercial establishments, the "dirty work" of actually getting cable from point "A" to point "B" is proving a new challenge to many first-timers.

As a recently concluded series in SatFACTS covered, you have two choices: Overhead (so-called "aerial" using local power or telephone [utility] poles to support the cable), and, underground. A third sub-option is to follow private property fence and property lines using a combination of slightly above and slightly below ground to progress parcel by parcel. Cable system builders in portions of Australia report they are being faced with per pole rental fees of up to A$30 per pole per year. Is this a doable number? Probably not except in very populated regions with unusually high costs associated with burial of cable. One benchmark is the US$5 per pole per year rates that are fairly uniform there. Another is the NZ$10 per pole per year rate being paid by some New Zealand cable TV operators.

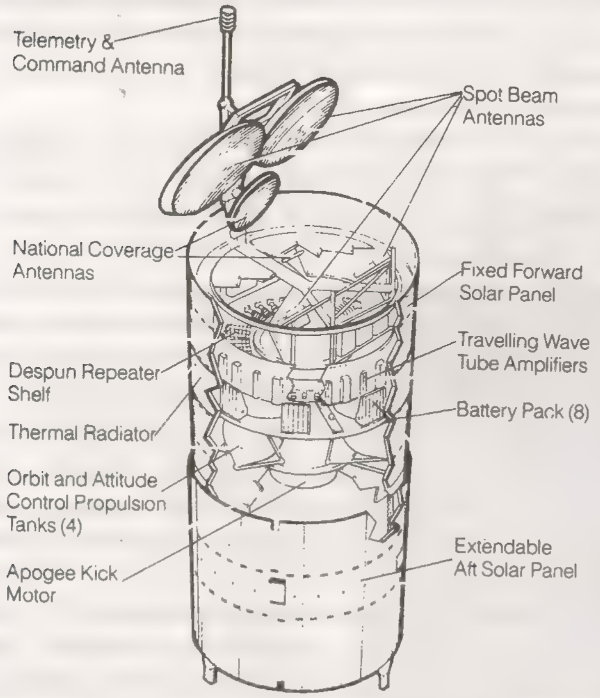
The total initial cost of aerial construction should not exceed A/NZ$1.50 per metre for construction labour and the "normal" hardware (bolts, clamps, J-hooks) required for pole attachment. The cable of course, plus the cable plant directional taps, connectors, amplifiers and power supplies are on top of this.

Underground plant construction is done one of several ways. A Vibrating Plow is fast but the equipment available (for rent or in contractor hands locally) may not be designed to handle 250kg rolls of .500 jacketed direct burial cable. A chain trencher is the most popular tool; it can move ahead at rates of up to 30 metres per hour in "normal" soil digging a typically 11cm wide trench in the process at a depth of up to 1 metre. A small tractor fitted with a "digger" can come fairly close to this speed rate in open country. The disadvantage to chain trenchers and diggers is that unlike the vibrating plow which digs and feeds the cable from the spool into the hole in one operation, they require a separate cable laying step after the trench is opened. A market reasonable rate for trenching should be in the range of A/NZ$1.75 to $2.50 per metre; slightly more if the contractor is equipped with a vibrating plow rig that also lays the cable in place as well. A reasonable budgetary figure is A/NZ$3.50 per metre to dig the trench, roll out the cable, and fill the trench back in (in open ground or across laws at the edge of a curb).

Streets, sidewalks and pavement that must be "crossed" with buried cable plant is a particular challenge. While it is possible to slit open a pavement to drop the cable into the ground, the cost to you for replacing the pavement or concrete will almost always cost more than "thrusting." This involves a hydraulic ram that uses brute force to drive a hardened metal tool "tip" under the paved area. You start from a hole dug at one side of the paved area and ram your way beneath the paved surface to a target hole at the opposite side. Contractors typically charge by the hole diameter and a 2.5cm / 1" hole (tunnel, actually) should be in the region of A/NZ$4 to 7 per metre. A 10cm / 4" hole typically will cost around A/NZ$25 per metre. For most cable TV applications, a 2.5cm hole is adequate. Most cable firms push a 2.5cm PVC medium wall thickness section of PVC through the hole to avoid having to repeat the thrusting process should they ever require crossing of the street in the future at the same location. You then pull your coaxial cable through the PVC "tunnel."

Most councils will require written approval before you cross over or under a street and this usually involves the district engineering department to some extent. There are cautions: Even if the council does not demand that you carry public liability insurance, take it out anyhow. For a cost in the range of A/NZ$500 per year, you should be able to locate coverage that will protect you should there be an accident. Another "accident" you don't want to have is to trench or thrust your way into and through something that is already there. In the case of buried telephone lines, you should find the district telephone company engineering office willing to: (a) Provide you with maps in advance of your planning / digging showing their buried cable locations, and, (b) Send a field person to your proposed trenching / thrusting site(s) in advance to give their clearance to your construction activity. Many telephone firms have site inspection documents which the inspecting engineer will sign and hand to you after clearing your planned work. This sheet basically tells you that if you dig or thrust where you say you will, and you hit something that belongs to the telephone company, it is their fault,. not yours. Similarly, where power lines are buried you should also clear with the power utility as well. And the water company. As a matter of law, if you have asked them to approve your trenching / thrusting, the

CURIOUS HOW THEY FLY?



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responsibility for damage to existing buried systems shifts from you to them when they give you approval to proceed. If you fail to get their approval, and hit something, you could be facing a multi-thousand dollar repair bill. Ripping apart a 100 pair telephone cable will be a significant shock to your company chequebook if you are at fault!

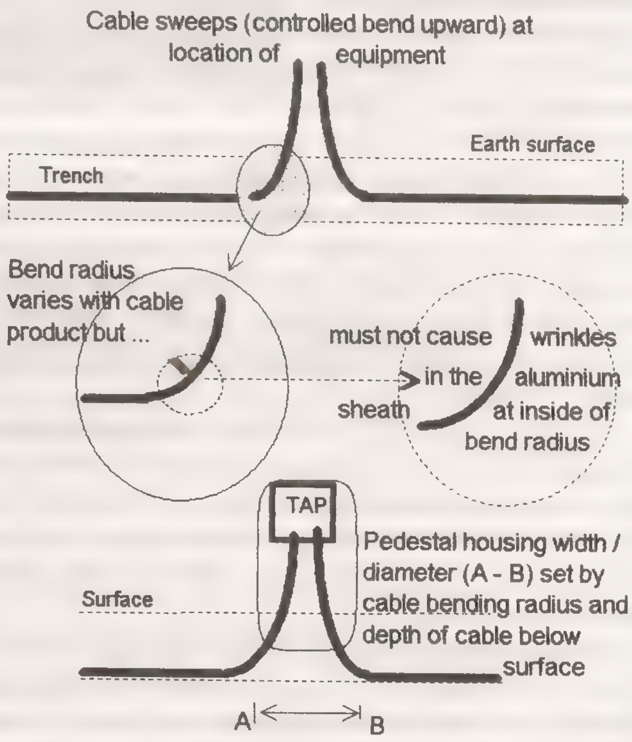
Equipment Housings

In areas where utility lines are underground, there are two primary categories of ground mounted "pedestal" equipment housings:

1) Those designed for (and perhaps manufactured for) the telephone company needs, and,

2) Those for power service lines.

Generally, neither of these categories are suitable (or priced for) cable TV use. Firms such as Vynco (PO Box 12249, Penrose, Auckland; tel 64-9-526-6051 or fax 64-9-525-5799; Alan Swailes) catalogues of "Enclosures" intended for these industries. Some models may be suitable to cable; most will not be and their price tags (upwards of A/NZ$200 each) will be your first clue.



Cable TV equipment housings fall into two classes: Those that will house only the customer feeding "Directional Tap" device, and those that will house amplifiers, trunk and feeder line splitters and associated component parts. In the first case, a directional tap typically measures less than 9cm in width (four outlet tap) which means that in theory it could be housed ("covered") with a 10cm ID piece of PVC pipe. Some cable operators purchase 5m lengths of 10cm PVC and make up their own customised tap pedestal housings. We'll look at this option in SF#15.

SatFACTS PACIFIC OCEAN ORBIT WATCH: 15 October 1995

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IF Freq	Gz25/103	G1/130	Gz18/140	G2/142	Gz21/144	P169/Vt	P169/Hz
1,475	DubITV	RAJ(X2)	DubITV	ATN	DubITV		
1,425	Muslim	SunMovie	Muslim	JJAY			
1406/1425						CMT/CBS	ABN/CTN
1,375	APNA	ABC-5/d		(CellFone)			
1346/1372						MTV/b	Discov/b
1,325		AsiaNet		EagleNet			
1288/1300						ESPN/b	OccVid
1,275		(vacant)		EMTV	Moscow 2		
1235/1249						P2/Sylmar	AsiaFeeds
1,225		SunMusic		Udaya			
1161/1183						Prime/d	CNN (X2)
1110/1115							NHK
1038/1060						ANBC	Fil.Ch/d
998/985						TNT.Car/b	(data)

JCSAT-3 / 128E
Testing began 07/10 with carriers noted IFs of 1107, 1122 (Hz) & 1197

IF Freq	180/RH	180/LH
1,432	Keystn	
1,388	MPEG	
1,325	MPEG	
1,310	MPEG	
1,277	NBC/e	
1,256	Keyston	
1,223	CBS/e	
1,179	W'Net	
1,137	NHK/e	
1,105	RFO	1092/data
1,054	(data)	Canal +/d.
1,021	Aust 9	Aust.9
988	NZ/dig.	
980	NZ/dig.	
972	NZ/dig.	
964	NZ/dig.	

I177E/I174E
IFs of 984 & 963 carry many international news feeds in right hand circular; on I177E, IF of 973 carries AFRTS in B-MAC, left hand circular with AFRTS radio subcarrier. Both birds also loaded with narrowband carriers.

October 1995 NOTES

- ►/b is B-MAC (NTSC or PAL depending upon service)
- ►/d or /dig. is some form of digital (MPEG)
- ►Intelsat I180 includes right and left hand circular transmissions (separate)
- ►/e indicates some form of analogue encoding (such as Leitch system on I180) for which there is no readily available decoder►(X2) indicates 1/2 transponder format with typically two programmes present
- ►Ku IF's for A3 and B1,3 satellites (below) are for standard LNB LO of 11,300

ANBC indicates reception on 3m or smaller antenna

TNT/Car <u>underline</u> indicates subscriptions may be available/SF#10, p.18

Ku BAND ACTIVITY UPDATE

A3/B1TR	IF Freq	B3: 155.9E	B1: 160.0E
1(V)	977		Tab radio; data
5L(V)	1,193	ETV>0000UTC	Occ.Video, news
5U(V)	1,218.8		Occ.Video
7L(V)	1,344	TVO>1200UTC	ABC Nation /b
7U(V)	1,370		SBS Nation /b
10(H)	1,075.75	Galaxy NTL digi	Galaxy GI Digital
11(H)	1,138.5	Galaxy NTL Digi.	Galaxy GI Digital

Optus B3 service has proven to be 'tighter' in control of footprints than B1, resulting in less signal spillover into regions outside of the transmit antenna's design footprints. Galaxy DTH (and MMDS feed) service is now on B3, B1 (GI Digicipher) is scheduled to terminate 15 November. B3 Galaxy signals average 3-4 dB lower than B1 Galaxy signals across NZ. B3 on 12.463 is stronger in New Caledonia than B1 signals, other B3 signals there are weaker than B1. Thanks to observers Colquhoun, Holzt, Cratt et al.

Satellite	RF Freq	Coverage Beam	Service Report
PAS-2	12,334	NE Asia	Now MPEG
PAS-2	12,700	NE Asia	PAS-2 Sylmar
177W	10,980V	Japan, Asia	US Net feeds
177W	11,015V	Japan, Asia	NBC News
177W	11,510V	Japan, Asia	
180E	11,480H	Japan, Asia	CBS
180E	11,510H	Japan, Asia	CNNI
145E	11,525H	Asia	Sakha TV/occas.
130E	11,525H	Taiwan, China	(Cable pgming)
96.5E	11,525H	Asia	Active ??

SatFACTS DATA SHOPPE

YOUR Source For Reference. Study Materials In The World Of Satellite TV

ENTRY LEVEL:

☐ **SATELLITE TELEVISION: All You Need To Know.** Brand new 28 page booklet with four-colour cover designed to help you educate potential customers about the joys of owning a home dish system. Sold through SPACE Dealer Members at $10 to individuals. Single copies available via fast post within NZ (NZ$10) or elsewhere (US$10) using order form on page 29 here.

☐ TB9402 / **MATV: Master Antenna Television Systems**. How to plan, select equipment for and install multiple outlet systems for motels, hotels, apartment flats and condos. Practical step by step guidance. Price: NZ$20 world-wide.

☐ TB9404 /**Home Satellite Systems**. What the parts are, how they go together for POR home TVRO systems; how you create a working system with maximum performance at minimum outlay. Price: NZ$20 world-wide.

☐ TB9405 / **Commercial Satellite Dish Systems** (SMATV). If you are building a system from scratch, also order TB9402 for the MATV portion basics. If you are rebuilding an existing MATV system to add satellite signals, you need this! Price: NZ$20 world-wide.

■ ALL 3 (TB9402. 9404, 9405) as a package for NZ$40 (you save $20).

DISH OWNING ENTHUSIAST LEVEL:

☐ **Coop's Satellite Operations Manual**. Originally written 1980, this manual explains how you locate and interpret the multitude of wide and narrow band signals available via satellite. Dozens of fun, new ways to get more from your dish system. Price: $NZ30 world-wide.

☐ **Gibson Satellite Navigator** (O/w 1980). The mechanics of the Clarke Orbit Belt, how a dish tracking system is designed and operated to allow full horizon to horizon reception with a motorised dish system. Very practical, very hands on with plenty of do-it-yourself instruction for inexpensive systems. Price: NZ$30 world-wide.

☐ **Coop's Basic Manual on Fine Tuning Satellite Terminals** (O/w 1980). The little things such as feeds, connectors, powering. Tips from the people who started home dish reception in the 1970s, building the foundation for the present TVRO industry day by day, discovery by discovery. Very practical, very hands on. Price: $NZ30 world-wide.

■ ALL 3 (Two from Coop, one Gibson) as a package for NZ$70 (you save $20).

BUSINESS MANAGEMENT REFERENCE MATERIAL:

☐ **CTD 9503 / COPYRIGHT - How It Works, Your Liabilities**. Must reading for anyone planning to distribute satellite programming to motels, hotels, communities. Price: NZ$30 world-wide.

☐ **CTD 9504/ GALAXY** - The detailed, inside story of what it is, where it wants to go. If you are hoping for Ku-band DTH in Australia and New Zealand, Galaxy is the most promising programme provider. Price: NZ$30 world-wide.

☐ **CTD 9507/ PLANNING AN UPLINK - How You Make Money.** A thorough outline for making money and avoiding bottomless pit investments in the creation of a Teleport (uplink) service. Price: NZ$30 world-wide.

 TO ORDER - USE BOTTOM OF CARD TO RIGHT

SatFACTS October 1995 POR OBSERVER REPORTING FORM
(Please FAX [64-9-406-1083] or mail to arrive by 03 November)

TELL US what you are seeing, or using for equipment, that is new within the last 30 days. Observer reports (see "With The Observers" page 22) form an important part of the growing body of information we all share monthly.

- NEW programming sources seen since 1 October: (Please list receiver 'IF' or satellite transponder number if known) ______

- CHANGES in reception quality since 1 October: ______

- EQUIPMENT changes at my observing terminal since 1 October: ______

- My Name ______ Address ______

Town / City ______ ______ Country ______ **(Please turn form over)**

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Payment and card to: **SatFACTS, PO Box 330, Mangonui, Far North (New Zealand)**

SatFACTS DATA SHOPPE ORDER FORM

I wish to order the following reference materials (see description page 28):

☐ **SATELLITES:** All You Need To Know ($10 inside NZ, US$10 elsewhere; description p.26)
☐ **TB9402 / MATV** (NZ$20; SPACE Members $15).
☐ **TB9404 / Home Satellite** (NZ$20; SPACE Members $15).
☐ **TB9405 / Commercial Satellite** (NZ$20; SPACE $15).
☐ ALL THREE / TB9402, 9404, 9405 (NZ$40; SPACE $30)
☐ **Coop's Satellite Operations** (NZ$30; SPACE $20) .
☐ **Gibson Navigator** (NZ$30; SPACE $20).
☐ **Coop's Basic - Fine Tuning** (NZ$30; SPACE $20).
☐ ALL THREE / OPERATIONS, NAVIGATOR, BASIC (NZ$70; SPACE Members $50).
☐ **CTD 9503 / Copyright As It Applies to Satellite Reception** (NZ$30; SPACE Members $20)
☐ **CTD 9504 / GALAXY: The Inside Story** (NZ$30; SPACE Members $20)
☐ **CTD 9507/ UPLINKING:** An Investment Opportunity (NZ$30; SPACE Members $20)

Instructions:
☑ Check off items you wish airmailed to you
▪ Make cheque to Far North Cablevision Ltd. or provide VISA info
▪ Complete reverse side of card

- YOUR equipment survey:

Size dish(es): ____________________; Noise Temp LNB(s): ____________________

Make/model receiver(s): ________________________________

Make/model standards conversion: ________________________________

If mailing report: SatFACTS Monthly, PO Box 330, Mangonui, Far North, New Zealand

SOUTH PACIFIC REGION SATELLITE & CABLE SHOW / SPRSCS INFO PACK REQUEST

The SPACE SPRSCS Show is January 23-27 in Auckland: Five days of seminars, exhibits and much more.

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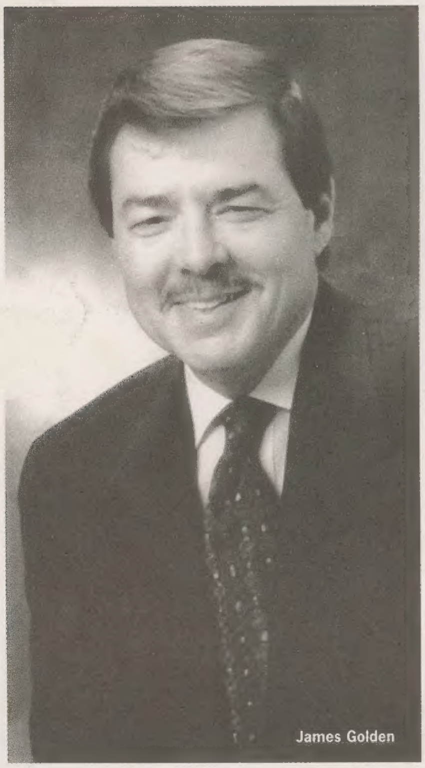
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